
PRODUCTION, COMPOSITION AND USES OF *ALOE VERA* (L.) BURM F.

Janet O. Alegbejo*Department of Paediatrics**Ahmadu Bello University Teaching Hospital, Shika, Zaria, Nigeria.***ABSTRACT**

Aloe vera (L.) or Indian aloe is an ancient crop and is cultivated as a cash crop. The dried exudate contains many chemical compounds which when activated have several medicinal uses. The American continent supplies about 60% to the world market, while the main producers are Mexico, Dominican Republic and Venezuela. Asia (China and Thailand) and Australia produce the remainder of the internationally traded product. Although it has many uses, it may also have possible side effects such as production of allergic reactions when applied on the skin. Future research needs are also discussed.

INTRODUCTION

Aloe vera (L.) Burm f. is called by various names worldwide (Barbados aloe, coastal aloe, Curacao aloe, Indian aloe, medicinal aloe, Mediterranean aloe, true aloe, West Indian aloe, Aloes, aloes vulgaire, aloe vera, caraguata and erva-babosa). It is either cultivated or naturalized and probably originated from Arabia, Somalia, Sudan or Southern Africa. *Aloe vera* belongs to the group of xeroid plants which close the stomas of their leaves after any cut or wound in them. Hence they avoid loss of moisture. Aloe belongs to Family Liliaceae, and grows up to 3-4 m high and has lanceolated, spiked leaves, and red yellow flowers which hang from a large stem. It is found throughout the tropics and subtropics (particularly Africa) and is cultivated as a cash crop in the Americas, Asia and Australia (Duke and duCeiller, 1993; Gurib-Fakim *et al.*, 1995; Tanaka, 1976; Usher, 1974). *Aloe vera* has been used by the Greeks since about 400 B. C. (Facciola, 1990; Pamplona-Roger, 2002; Schmelzer and Gurib-Fakim, 2008). Aristotle mentioned Aloe which grew in the Indian Ocean island called Socotora to the great king Alexander the Great (Pamplona-Roger, 2002). The plant was known to have a quick healing when any of the fleshy leaves is cut; hence it was thought that it will also heal the wounds of humans who will be treated with the plant (Pamplona-Roger, 2002).

COMPOSITION

The dried exudate of *Aloe vera* contains 15-40% anthrone 10-C-glucosides (anthraquinone derivatives) such as aloin and hydroxyaloin. Aloin contains the stereoisomers aloin A (barbaloin) and aloin B (isobabaloin). The exudate contains the pyrone derivative aloin and free and glucosylated 2-acetyonyl-7-hydroxy-5-methylchromones (aloesone, furoaloesone, aloeresin A, aloeresin B (aloesin) and aloeresin C) (Chow *et al.*, 2005; Dagne *et al.*, 2000; Pamplona-Roger, 2002; Reynolds, 2004; Ross, 2003; Schmelzer and Gurib-Fakim, 2008). "Curacao aloe" contains about 28% hydroxyl-anthraquinone derivatives; it is soluble in 60% alcohol and 70% soluble in water; it contains 12% moisture and 3% ash (Cerquiera *et al.*, 1999; Diehl and Teichmuller, 1998). Aloin is responsible for its laxative properties, but in

itself is inactive as a laxative, but is activated by aloe-emodin anthrone, by *Eubacterium* sp. (Pamplona-Roger, 2002; Schmelzer and Gurib-Fakim, 2008).

PRODUCTION

Vegetative propagation is usually preferred to seed because of poor seedling emergence and faster initial growth of suckers. Suckers can be cut from the mother plant when they are 15-20 cm long (Liao *et al.*, 2004). They may be grown in a nursery during the first year. They are grown in the field or in the greenhouse. Plant densities used are variable (average of 60,000.0 plants/ha, optimum of 15,000.0/ha is optimum). Plants are fully matured in about 3 years, and leaves may be harvested for about 7 years. The exudate is collected by cutting off the leaves transversely close the stem. The juice is allowed to drain into pots, tubs or vessels. The juice may also be obtained by squeezing the leaves or by warm or cold water retting. The leaves are cut in the morning and allowed to drain for about 4-5 hours. Harvesting is done at intervals of about 3 months. In situations where selected leaves are cut, mechanical harvesting is limited. *Aloe vera* plants produce about 16-20 leaves per year under management. When plant density is about 50,000/ha, and an average fresh leaf weight of 0.2 kg, then gel weight of about 180 t/ha could be obtained (Das and Chattopadhy, 2004; Schmelzer and Gurib-Fakim, 2008). The exudate collected is concentrated by boiling and subsequent cooling or by vacuum evaporation. The amorphous extract which is opaque is called 'Curacao aloe'. For gel production, the cut leaves are transferred to water baths where debris is washed off. The leaves are taken to the factory for filleting. Each leaf is topped and tailed and the sides cut using a sharp knife. The outer tissues of the leaf are removed and the leaf processed quickly to avoid degradation of the polysaccharides. Sometimes whole fresh leaves are marketed. The total annual production of *Aloe vera* gel products was about 125 million US dollars in 2004 which is expected to grow at a rate of 35% over the next five years (159.75 million US dollars by 2013). The American continent supplies about 60% to the world market. The main producers are Mexico, Dominican Republic and Venezuela. Asia (China and Thailand) and Australia produce the remainder of the internationally traded product. The *Aloe vera* produced commercially in Nigeria is used internally (local market) (Schmelzer and Gurib-Fakim, 2008).

USES

The exudate 'aloe' which is bitter is contained in the pericycle cells of the vascular bundles in the leaf are used dried as a laxative or purgative, oxytocic (promotes uterine contractions) and vermifuge. The fresh exudate is applied externally as a refrigerant to treat acne or cuts. When mixed with other ingredients to mask its bitter taste, it is used to treat asthma, coughs, dysentery, kidney problems and dyspepsia. The exudate is used as a bittering agent for food and beer. Aloe gel has several medicinal uses (Grindley and Reynolds, 1986; WHO, 1999): the gel or peeled leaves are applied to treat burns, wounds (for two days after the burn – for first degree burns, two or three days of treatment, for more severe burns, the doctor should be consulted), abrasions, skin diseases (e.g. eczema, athletes' foot, acne, and herpes), irritations (measles, rubella, and chicken pox) (Richardson *et al.*, 2005), haemorrhoids and as a poultice on contusions or as a general refrigerant; one to two

spoonful are taken three or four times a day, dissolved into water, fruit juice or milk; the peeled leaves are eaten to relieve sore throat, coughs, treat diabetes (Yeh *et al.*, 2003), and as a laxative and emmenagogue to increase menstrual flowering; has appetizer, stomach and cholagogue properties to promote digestion; as a hair wash to promote hair growth and against dandruff; as a general cosmetic to improve the complexion and smoothens the skin (revitalization and beautification - improves appearance of scars and cracks); nail and hair care; as food supplement to facilitate digestion; depurative and invigorating properties; treatment of gastro-duodenal ulcer; as an anti-irritant and improve blood and lymphatic circulation; kidney, liver and gall bladder functions; acemanana contained in aloe juice is used to stimulate the defenses of the body (activates the lymphocytes-by destroying cancer cells and cells infected by the HIV/AIDS virus (Eshun and He, 2004; Pamplona-Roger, 2002; Schmelzer and Gurib-Fakim, 2008; Reynolds and Dweck, 1999). *Aloe vera* has been used to heal the wounds of many people throughout history. Greek soldiers, Roman emperors, and warriors from many countries have been treated with this plant (Pamplona-Roger, 2002). Bitter aloes is used in pills and, pharmaceutically made. *Aloe vera* is used externally in many ways: compresses with aloe juice, keep them for whole day, soaking them with juice every time they get dry; at night olive oil or an hydrating cream can be applied because aloe cream dries the skin; lotion with aloe juice applied two or three times a day on affected skin area in combination with the use of some emollient (soothing) such as olive oil; many creams and ointments and other pharmaceutical preparations based on aloe are used as emollient or hydrating substances (Ekpendu, 2004);

Strickland and Pelley, 2004; Pamplona-Roger, 2002). It is said to be beneficial HIV/AIDS and arthritis patients and those with other debilitating conditions, but these have not been scientifically proven. The gel is used to treat sprains, muscle pain, callosities of the feet, manufacture of commercial jellies, drinks, ice-cream, as a coating on grapes to lengthen the shelf life (Valverde *et al.*, 2005) and as gel powder (1%) addition to concrete which gives the reinforcing steel better resistance against corrosion (Torres-Acosta *et al.*, 2005). The leaves and seeds are cooked and eaten as vegetable (Schmelzer and Gurib-Fakim, 2008). Aloe gel has a reputation as miracle drug: it is effective for burn treatment (anti-inflammatory and wound healing properties); the healing properties may be due to rehydrating, insulating and protective activities resulting from the high water content; it contains acemanana which has immune stimulating, anticancer and antiviral effects; for treating leukaemia in cats, fibrosarcoma in dogs, wound healing in humans, and for preventing dry socket (alveolar osteitis) in humans; for the treatment of psoriasis; in combination with the immunomodulating neurohormone melatonin, it may produce therapeutic benefits by stabilizing disease and survival. *Aloe vera* is grown as an ornamental in gardens or pots (Pamplona-Roger, 2002; Schmelzer and Gurib-Fakim, 2008).

SIDE EFFECTS

The possible side effects of aloin include: aloe jell or juice can produce allergic reactions when applied on the skin- one out of every 200 people is allergic to aloe; bitter aloe should not be used by pregnant women, nor during menstruation because it produces congestion

and irritation of the pelvic organs and uterine contraction; it should not be used by people suffering from haemorrhoids (it makes them bleed); should not be used by children; dosage should not exceed 0.5 g per day; anthraquinone laxatives may play a role in the development of colorectal cancer because they have genotoxic potential and tumorigenic potential in rodents (Aguilar and Brink, 1999; Pamplona-Roger, 2002; Schmelzer and Gurib-Fakim, 2008). Aloin and aloiresin B have skin-whitening activity.

PROSPECTS FOR FURTHER RESEARCH

Identity of the *Aloe vera* plants tested in various researches should be ascertained; the products from the various cultivars should be standardized (Abe and Talmadge, 2004); contamination of the gels with exudate should be avoided; high yielding cultivars need to be selected and propagated for commercial use; breeding for desirable characteristics should be done (high leaf and juice yield); identification of the active ingredients of *Aloe vera* and its mechanism of action is very important; more medicinal uses should be sort; commercial production of the plant in arid zones is very feasible and should be encouraged.

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